than 50 percent of its floorspace used for commercial activities."[88] It "include[s], but [is] not limited to . . . stores, offices, schools, churches, gymnasiums, libraries, museums, hospitals, clinics, warehouses, and jails."[89] There are 4.6 million buildings within this category.[90]

"Commercial buildings" are comprised of 11 separate categories,[91] although AT&T discusses only nine.[92] One of these categories is the "office" buildings category used in the *Fact Report*, which represents 705,000 buildings.

AT&T concedes that it is appropriate to exclude most if not all of at least four categories (Public Assembly, Warehouse, Food Sales, and Food Services[93]) that "might not be communications intensive," and to exclude a fifth category (Education) because it "might not be a prime market for special access"[94] Excluding these five categories reduces the total from 4.6 million to 2.9 million.[95]

The two categories that AT&T fails to list or discuss are "religious worship" and "other," and it is clear that both of these categories should also be excluded. According to the Department of Energy, the "religious worship" category "refers to buildings in which people gather for religious activities," including "chapel, church, mosque, synagogue, temple."[96] The "other" category "refers to buildings that do not fit into any of the specifically named categories" and that are typically buildings that contain "several commercial activities that, together, represent 50 percent or more of the floorspace, but whose largest single activity is agricultural, industrial/manufacturing, or residential."[97] For example, this category includes "crematorium, hangar, public restroom/showers, telephone exchange, greenhouse with retail sales of plants, manufacturing with retail sales of products, printing plant with retail sales, mechanical/electrical laboratory, mental/dental laboratory." It is clear that most if not all of the buildings in this list

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[88] *Commercial Buildings Report* at 382.

[89] *Id.*

[90] U.S. Dep't of Commerce, *Statistical Abstract of the United States 2000* at Table 1228 (citing the *Commercial Buildings Report*).

[91] *Commercial Buildings Report* at 365-368.

[92] Pfau Reply ¶ 42.

[93] Pfau Reply ¶ 43. AT&T doesn't actually include "food services" in the list of categories that it excludes, but it's math indicates that it did exclude this category, as AT&T claims that after excluding you get to 3,095,000 buildings, which is the 4,579,000 less the four categories ATT cites plus this one. *See id.*

[94] Although AT&T says that "there is no basis to eliminate the entirety of these categories," Pfau Reply Aff. ¶ 43, the Energy Department's descriptions of these categories make clear that it is appropriate to do so.

[95] AT&T's calculation appears different because it misstates the number of buildings in the Public Assembly category as 269,000 rather than 326,000. *See* Pfau ¶ 43. The 269,000 figure is the number of buildings in the Religious Worship category, which AT&T leaves out completely.

[96] *Commercial Buildings Report* at 368.

[97] *Id* at 367.

contain businesses that are not typical purchasers of special access or high-capacity services.

Excluding the "religious worship" and "other category" reduces the total from 2.9 million to 2.2 million. And of this 2.2 million, 705,000 are the office buildings used in the *Fact Report*.

As for the remaining 1.5 million buildings that AT&T argues should be included in the denominator, 1.29 million are categorized by the Department of Commerce as "mercantile/services," 158,000 are categorized as "lodging," and 105,000 are categorized as "healthcare." Simply looking at the Department of Energy's own description of the kind of buildings included in this category proves beyond serious dispute that the vast majority of businesses these buildings contain do not frequently, if ever, purchase special access or high-capacity services.

The "mercantile and services" category "refers to buildings used for sales and displays of goods or services (excluding food).[98] This category includes shopping malls and strip centers," as well as "automotive dealers, building materials, garden supply, and hardware stores, drug stores, furniture, home equipment stores and home furnishings, liquor stores, wholesale goods, dry cleaner/car wash/laundry, gasoline stations, motor vehicle repair/service/maintenance, multiservice establishments, personal service, post office."[99] None of the kinds of business on this list — most of which are very small businesses with no more than a handful of phone lines — are typical purchasers of special access or high-capacity services.

The "lodging" category includes "buildings used to offer multiple accommodations for short-term or long-term residents, including nursing homes," and includes "convention hotel, hotel, inn, motel, shelter home, tourist home, . . . boarding house, convent/monastery, extended stay hotels, dormitory/sorority/fraternity, orphanage, assisted-living elder care facilities, . . . home for the aged, nursing homes."[100] Most of the 158,000 business in the "lodging" category are not typical purchasers of special access or high-capacity services, and are therefore properly excluded. One potential exception is large hotels, of which there are fewer than 17,000 nationwide.[101]

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[98] *Id.* at 366.

[99] *Id.* at 366-367.

[100] *Commercial Buildings Report* at 366.

[101] *See* U.S. Census Bureau, *1997 Economic Census, Accommodation & Foodservices - Subject Series*, at Table 1 (rel. Oct. 12, 2000). There are approximately 17,000 hotels in the U.S. with 25 guestrooms or more, and lodgings smaller than that are extremely unlikely to purchase special access or high-capacity services. Moreover, a large fraction of the hotels with 25 guests rooms or more also are unlikely to purchase such services. For example, 2,500 of such hotels are establishments that are not even operated for the entire year, and another 6,000 of those establishments have total sales of less than $500,000 per year. *See id.*

The "health care" category includes "buildings used as diagnostic and treatment facilities for both inpatient and outpatient care," and includes medical care hospitals, mental facilities (mental retardation/schools for the mentally retarded, psychiatric), rehabilitation facilities (alcoholism, substance abuse/narcotics/drug addiction, physical therapy), dental clinics, medical clinics, mental health/psychiatric clinics, and veterinary facilities.[102] At most a tiny fraction of this category — perhaps the full-size hospitals, which number fewer than 7,000 nationwide[103] — contain the kinds of businesses that typically purchase special access or high-capacity services.

In sum, it is clear that the primary customers of special access and high-capacity services reside almost entirely within the 705,000 "commercial office buildings" in the U.S., and not within the other nearly four million "commercial" buildings that include virtually every small business in the country. Indeed, the CLECs' own coalition uses the 705,000 figure in estimating CLEC building penetration. It is therefore appropriate to use the 705,000 figure as the denominator in calculating the percentage of buildings served by CLEC networks.

3. CLEC Collocation.

The *Fact Report* demonstrated that, under the Commission's own framework for measuring special access competition, special access competition was widespread. For example, it stated that in 183 of the 320 MSAs served by BellSouth, Qwest, SBC, and Verizon, one or more fiber based collocation arrangements existed in wire centers that cover at least 30 percent of the incumbent LECs' special access revenues in those MSAs. And that in 154 of these MSAs, one or more collocation arrangements exist in wire centers that cover at least 65 percent of the incumbent LEC's special access revenues in those MSAs.

AT&T and the other long distance incumbents raise only one factual dispute regarding this data. They claim that the collocation includes "a substantial number of collocations" that "are utilized by DSL-only providers" who are "essentially irrelevant to a determination of whether high-capacity loops and transport can be obtained outside the incumbent LECs' networks."[104] This is simply incorrect. In calculating the extent of collocation, the *Fact Report* excluded all collocation of DSL providers.[105]

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[102] *Id.*

[103] According to a Census Report, there are 6,685 hospitals in the U.S., the great majority of these buildings are either "outpatient" facilities, residential care facilities, or some type of "social assistance" facility. U.S. Census Bureau, *1997 Economic Census, Health Care & Social Assistance - Subject Series*, at Tables 1a & 1b.

[104] Pfau Reply ¶ 37.

[105] Apart from this wrong-headed attack, AT&T and Allegiance claim that collocation is not relevant for determining whether there are competitive alternatives for special access. AT&T Reply at 27; Pfau Reply ¶ 35; Allegiance at 22-23. This just rehashes the claims made before the Commission and the D.C. Circuit, which held that this was not only an appropriate framework for measuring special access competition, but a conservative one.

Before the
Federal Communications Commission
Washington, D.C. 20554

In the Matter of	)	
	)	
Implementation of the	)	CC Docket No. 96-98
Local Competition Provisions	)	
in the Local Telecommunications Act of 1996	)	
	)	
Joint Petition of BellSouth, SBC, and Verizon	)	
for Elimination of Mandatory Unbundling of	)	
High-Capacity Loops and Dedicated Transport	)	

REBUTTAL DECLARATION OF ROBERT W. CRANDALL

INTRODUCTION

1. I have been asked by BellSouth, SBC, and Verizon to respond to the comments filed by AT&T,[1] WorldCom,[2] and Sprint[3] (the "opponents") that address my economic analysis.

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1. An Economic and Engineering Analysis of Dr. Robert Crandall's Theoretical "Impairment" Study, on behalf of AT&T (June 11, 2001) [hereinafter *AT&T "Economic" Study*].

I demonstrate that the opponents ignore the market evidence on competitive fiber networks, and mischaracterize the metric that I used to characterize actual and potential competition in the special access services market. Finally, I show that the opponents seek to confound the impairment decision with superfluous information.

SUMMARY OF CONCLUSIONS

2. In part I of my declaration, I explain how AT&T argues for a market-based evidentiary standard for the impairment decision on the one hand, but ignores the overwhelming market-based evidence on the other—namely, facilities-based collocation, massive fiber deployment, and in particular, iMapData's depiction of the *actual* deployment of CLEC fiber networks in a variety of cities.[4] I explain in detail why each of the three criticisms of the fiber maps is without merit. Finally, I embrace the AT&T market-based standard (with one important caveat), and ask the Commission to reconcile the overwhelming evidence of facilities-based deployment with the notion that CLECs need access to ILEC high-capacity loops and transport.

3. In part II, I explain the one important caveat to my support of AT&T's market-based standard: some modeling tools can help inform the Commission's impairment decision. The models help the Commission avoid baseless assumptions that could lead the Commission to understate the degree of actual and potential competition in the special access services market.[5]

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2. Comments of WorldCom Inc. (June 11, 2001) [hereinafter *WorldCom Comments*].
3. Comments of Sprint Corporation (June 11, 2001) [hereinafter *Sprint Comments*].
4. AT&T also ignores the data on fiber-based collocation that was presented in the *Fact Report*. *See* Competition for Special Access Services, High-Capacity Loops, and Interoffice Transport, Submitted by the United States Telecom Association, Prepared for BellSouth, SBC, Qwest, and Verizon, CC Dkt. No. 96-98, at 4 (Apr. 5, 2001) [hereinafter SPECIAL ACCESS FACT REPORT].
5. In my reply declaration, I defined the special access services market as traditional special access, dedicated transport used in conjunction with switched access, and private line services. In particular, I focused

Next, I respond to the critiques of the metric that I used to characterize actual competition—that is, the extent to which CLECs can currently reach special access customers. I also respond to the critiques of the metric that I used to characterize potential competition—that is, the extent to which CLECs will have an incentive to reach special access customers in the future.

4. In part III, I explain how the opponents seek to confound the impairment decision with superfluous information. A handful of anecdotes cannot substitute for comprehensive market-based evidence. I demonstrate that neither dubious claims about capital market imperfections nor customer perceptions of CLEC quality should inform the impairment decision. I also explain why the delay associated with extending one's network to serve "off-net" customers cannot justify the unbundling of an ILEC's high-cap loops and transport elements.

5. Finally, I explain the fallacy of the opponents' contention that CLECs need access to ILEC facilities at total element long-run incremental cost (TELRIC) prices. Regardless of the precision of my cost estimates of network expansion, those costs are presumably the very basis for TELRIC—by design, TELRIC is supposed to reflect the cost of a brand new, efficiently-deployed network. It would be illogical to conclude that the forward-looking costs of building connections to customers are so high that CLECs need access to ILEC networks at rates based on these same forward looking costs. The Commission should, by now, recognize that it is being told by AT&T, WorldCom, and Sprint that the prices of unbundled network elements (UNEs) have been set *too low*, not that CLECs are impaired by lack of access to UNEs at costs that they can readily replicate.

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on the high-capacity segment, at speeds of DS-1 or above. This treatment is supported by the fact that between 78 and 89 percent of the special access revenues earned by the Bell companies is generated by customers using

I. THE OPPONENTS IGNORE THE MARKET EVIDENCE ON ACTUAL COMPETITION

6. AT&T's criticism of my study boils down to one point: the Commission should reject the conclusions of my study because they are entirely based on "theoretical models," which, AT&T argues, should not serve as the basis for an impairment decision under 47 U.S.C. § 251(d)(2).[6] Instead, AT&T points out, impairment decisions should be based on "market evidence."[7] To reach my conclusions about impairment, however, I relied on the very type of market-based evidence that AT&T purports to favor. For example, I relied on facilities-based collocation by CLECs and on evidence of fiber deployment from the *Fact Report*.[8] Facilities-based collocation provided the basis for the FCC's conclusion that there is no longer any need for price cap and other rate regulation for a significant portion of the special access market. As I explained in my reply declaration, with facilities-based collocation so widespread in so many places, competitive carriers cannot be impaired.

7. I also relied on evidence of actual CLEC fiber deployment to date. Indeed, the first half (28 of the 35 pages) of my study documents the extensive local fiber networks that CLECs have deployed in six cities across the United States. There is nothing theoretical about this empirical market evidence of *actual* competition. Thus, AT&T's assertion that I "[do] not

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DS-1 circuits or above. *See* Reply Declaration of Robert W. Crandall, filed on behalf of United States Telecom Association, at ¶ 14 (Apr. 30, 2001) [hereinafter *Crandall Reply Declaration*].

6. *AT&T "Economic" Study*, *supra* note 1, at 2 (citing Third Report and Order and Fourth Further Notice of Proposed Rulemaking, Implementation of the Local Competition Provisions of the Telecommunications Act of 1996, 15 FCC Rcd. 3696, ¶ 66 (1999) [hereinafter *UNE Remand Order*].

7. *AT&T "Economic" Study*, *supra* note 1, at 2. *See also* Comments of Mpower Communications Corp., at 7 (July 11, 2001) [hereinafter *Mpower Comments*] ("... [T]he Crandall Declaration doesn't try to present data for analysis. Instead, it presents a pyramid of theories and assumptions. . . . [The Crandall Declaration] might make an interesting academic treatise, but [its theories] are not well founded in fact and do not provide meaningful support for the Three RBOC Petition.").

offer any marketplace evidence"[9] simply blinks at reality. The overwhelming *market-based* evidence of extant CLEC fiber networks is further proof that CLECs are not impaired in the delivery of special access services without access to the incumbents' high-capacity loops and transport facilities.

8. My "theoretical modeling" of the special access market simply responds to arguments that, notwithstanding the existing facilities, carriers are impaired in provisioning of *additional* facilities. In particular, my breakeven model shows the degree to which CLECs profitably can expand their network to serve additional customers. This later analysis reflects the fact that the CLECs' existing networks represent just a snapshot in time. As then-Commissioner Powell observed, the deployment of alternative facilities by some CLECs in some locations "strongly suggests" that competitors "are not significantly impaired," both in areas where they have deployed "and in areas in which they have not done so."[10] While AT&T purports to dismiss the analysis as theoretical modeling (ignoring the substantial market-based evidence discussed above), its suggestion that the Commission rely instead on anecdotes and unverifiable internal assertions is hardly compelling.

A. The Opponents Cannot Dismiss the Evidence of Fiber Deployment

9. It is no accident that AT&T does not mention the evidence of fiber-based collocation nor iMapData's detailed maps of the CLECs' fiber networks until the very end of its

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8. *Crandall Reply Declaration*, *supra* note 5, at ¶ 6.
9. *AT&T "Economic"* Study, *supra* note 1, at 10.
10. *See* 1999 FCC LEXIS 5663 at **49.

comments.[11] In fact, when summarizing my methodology, AT&T casually omits the central role of the CLEC fiber maps in my allegedly "slipshod"[12] analysis:

> In order to undertake this thought experiment, Dr. Crandall developed a series of largely undocumented models intended to estimate (i) the location of possible high-capacity customers; (ii) the revenues to be gained by serving them, and (iii) the incremental costs of extending existing competitive LEC fiber facilities to reach these customers.[13]

A proper synopsis of my methodology would begin with a new part (i) entitled "the location of actual CLEC fiber networks." Clearly, AT&T is attempting to link the conclusions of my study to the model that I employ to characterize the degree of *potential* competition in the special access market. However, the first 28 pages of text, which characterize the degree of *actual* competition in the special access market, cannot be ignored. As long as the conclusions are entirely based on "three successive theoretical models,"[14] AT&T argues, the Commission should reject those conclusions under the market-based evidentiary standard established in the *UNE Remand Order*.[15] But the market-based evidence of actual competition—produced in the *Fact Report* and supplemented with fiber maps by iMapData—does not involve any theoretical modeling! Indeed, AT&T recognizes the importance of the fiber maps to my analysis when it claims weakly: "Rather than being plentiful, metropolitan fiber capacity is scarce and, as a result, the *entire* premise of Dr. Crandall's analysis and his conclusions come crashing down."[16] But it is AT&T's critique of the iMapData that is weak; that is why it is relegated to the back of its comments. I respond to the specific critique of the fiber maps below.

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11. *AT&T "Economic"* Study, *supra* note 1, at 38.
12. *Id.* at 24.
13. *Id.* at 9.
14. *Id.* at 2.
15. *UNE Remand Order*, *supra* note 6.

1. The Local Fiber Maps Produced by iMapData Do Not Include Long-Haul Fiber

10. AT&T finally acknowledges the existence of the CLEC fiber maps on page 38 of its 48-page comments, when it criticizes iMapData for including "interexchange backbone fiber" in its local fiber maps.[17] In particular, AT&T points to Level 3's downtown fiber networks in Cleveland and Seattle as evidence that iMapData included superfluous networks to inflate the impression of actual competition at the local level.[18] AT&T claims that "*none* of Level 3's fiber is local—it is all long-distance services."[19]

11. AT&T is wrong. According to Level 3's most recent 10-K filing at the Securities and Exchange Commission (SEC), the company owns and operates *both* local and intercity networks. Indeed, Level 3 devotes an entire section of its 10-K to its local market infrastructure:

> Local Market Infrastructure. The Company's local facilities include fiber optic networks connecting Level 3's intercity network Gateway sites to ILEC and CLEC central offices, long distance carrier points-of-presence or POPs, buildings housing communication-intensive end users and Internet peering and transit facilities. Level 3's high fiber count metropolitan networks allow Level 3 to extend its services directly to its customers' locations at very low costs, because the availability of this network infrastructure does not require extensive multiplexing equipment to reach a customer location, which is required in ordinary fiber constrained metropolitan networks. . . .
>
> As of December 31, 2000, the Company had operational, *facilities based local metropolitan networks* in 26 U.S. markets and six European markets.[20]

More importantly, Level 3's fiber depicted in the maps of Seattle and Cleveland (as is shown on the maps) *is* in fact used for local services, and iMapData has confirmed as much. This of course

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16. *AT&T "Economic"* Study, *supra* note 1, at 38 (emphasis added).
17. *Id.*
18. *Id.*
19. *Id.* (citing Pfau Declaration at ¶ 26) (emphasis in original).

should come as no surprise—it would not make sense for Level 3 to traverse the most expensive areas of downtown Seattle and Cleveland if the sole purpose of those networks was to carry long-haul traffic.

2. A CLEC's Fiber Does Not Disappear from the Fiber Map If That CLEC Declares Bankruptcy

12. AT&T makes one other attempt to dismiss the fiber maps produced by iMapData. Because iMapData included the fiber networks of e.spire in Tucson (e.spire has recently filed for bankruptcy), AT&T contends that iMapData has overstated the degree of actual competition in the special access market.[21] According to AT&T, the e.spire fiber network in Tucson should be stricken from the record. That line of reasoning is flawed for at least two reasons. *First*, even though it declared bankruptcy in March 2001,[22] e.spire continues to operate as of the time of this filing,[23] and thus should be counted in any assessment of the state of actual competition in the special access market in Tucson.

13. *Second*, a fiber network deployed by e.spire—or any other bankrupt CLEC—constitutes a sunk asset, which can be used subsequently by the failed carrier itself, or by another carrier that acquires its established facilities. For example, in May 2001, Cable & Wireless

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20. LEVEL 3 COMMUNICATIONS INC., SEC FORM 10-K, at 7 (filed Mar. 8, 2001) (emphasis added). Level 3 lists Cleveland and Seattle as "market[s] in service" in a Table within the section on Local Market Infrastructure.

21. *AT&T "Economic" Study*, *supra* note 1, at 38. *See also Mpower Comments*, *supra* note 7, at 17 (criticizing me for failing to recognize the importance of "the fact that several CLECs have filed for bankruptcy in the last six months.").

22. Jerry Knight, *An Imploding Telecom Sector Tests Darwinism*, WASH. POST, Mar. 26, 2001, at E1.

23. *e.spire Receives Final Approval for DIP Financing*, PR NEWSWIRE, June 12, 2001. The Bankruptcy Court of the District of Delaware approved the remaining $45 million of the $85 million debtor-in-possession financing for e.spire.

announced that it had allocated $7 billion to acquire a recently bankrupted American CLEC.[24] Similarly, if e.spire ceased to operate, its facilities could be acquired by another CLEC looking to fill a hole in its nationwide network. Therefore, the CLEC fiber networks that are currently deployed should be counted in any competitive assessment of the special access market.

14. In fact, AT&T's prescription for the treatment of capacity owned by a bankrupt carrier—a prescription, incidentally, that is the polar opposite of what AT&T argued when it was seeking deregulation of its own services—has already been rejected by the Commission. In its *Pricing Flexibility Order*, the Commission explained that it would consider facilities-based investment as a sunk investment:

> Investment in facilities, particularly those that cannot be used for another purpose, is an important indicator of such irreversible entry. If a competitive LEC has made a substantial sunk investment in equipment, that equipment remains available and capable for providing service in competition with the incumbent, even if the incumbent succeeds in driving that competitor from the market. Another firm can buy the facilities at a price that reflects expected future earnings and, as long as it can charge a price that covers average variable cost, will be able to compete with the incumbent LEC.[25]

The Commission has espoused this treatment of facilities-based investment for over a decade.[26]

3. The Fiber Maps Cannot Be Rejected by a Casual Eye-Balling of the Data

15. Finally, WorldCom accuses iMapData of including routes in its fiber maps where "WorldCom has no facilities at all."[27] Although it is conceivable that iMapData did not perfectly

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24. Dan Roberts, *C&W Hopes to Acquire U.S. Phone Operator*, FIN. TIMES, May 17, 2001, at P23. Several carriers have recently acquired the assets of failed CLECs, including AT&T, Hughes, McLeod, WorldCom, and XO Communications.

25. Access Charge Reform, Price Cap Performance Review for Local Exchange Carriers, 14 FCC Rcd. 14221, 14264 (1999).

26. *See, e.g.*, Competition in the Interstate, Interexchange Marketplace, Notice of Proposed Rulemaking, 5 FCC Rcd. 2627, 2634 (1990) (explaining in the context of the long-distance services that "even if an existing facilities-based carrier exits the interstate market, its supply capacity likely will remain available to other IXCs and new entrants.").

trace the path of each CLEC's fiber network,[28] WorldCom does not provide substantive evidence to support such a claim. Nor does it even show the *extent* to which the iMapData is purportedly inaccurate. Instead, WorldCom offers up a declaration by a WorldCom employee, who claims that he caught the "error" through casual inspection:

> Third, the CLEC network maps *appear* to be inaccurate. To the extent that I can discern the claimed path of WorldCom's network on the maps in the Crandall Declaration, it *appears* that some of the routes shown on the map include WorldCom conduit that is *generally* not used for its local network; include long haul fiber routes; or are otherwise inaccurate.[29]

If these claims are to be given any credence, then they must be far more specific and documented. In the absence of such documentation, the Commission must conclude that either no such methodical assessment was performed, or the results of such an assessment largely confirmed the patterns of iMapData's fiber maps.

B. The Opponents Incorrectly Suggest That the Results of My Six City Survey Cannot Be Extended to Other Cities in the United States

16. WorldCom claims that my results are not representative of the general addressability of high-cap customers because I did not include any cities *larger* than Cleveland in the sample.[30] According to WorldCom, exclusion of the largest cities overstates the general

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27. *WorldCom Comments*, *supra* note 2, at 28.

28. Given iMapData's rigorous methodology, this is very unlikely. iMapData (formerly InContext Inc.) has been tracking the fiber configuration of CLECs since 1992 in more than 30 major urban markets. These mapped configurations have been created and maintained by following a combination of research methodologies that include: (1) contacting the local CLECs in any particular market; (2) contacting the local departments of public works; (3) contacting the incumbent RBOC; (4) contacting local construction companies that lay fiber; and (5) contacting the local commercial broker network that leases high-end commercial properties.

29. Declaration of Edwin A. Fleming, on behalf of WorldCom Inc., at ¶ 10 (June 11, 2001) (emphasis added) [hereinafter *Fleming Declaration*].

30. *WorldCom Comments*, *supra* note 2, at 30 (citation omitted). *See also* Comments of Z-Tel Communications, Inc., at 20-21 (July 11, 2001) [hereinafter *Z-Tel Comments*] ("In short, these cities are not 'representative' of cities of all sizes in the United States. As a result, general conclusions about the

degree of addressability because "demand in larger MSAs tends to be *dispersed* across a wider area, thus requiring more outside plant construction in order to address a particular percentage of the demand."[31] A quick inspection of the relationship between density and MSA size reveals the following fact: contrary to WorldCom's assertion, the top ten MSAs have an average population density of 1,044 persons per square mile, whereas MSAs eleven through twenty have an average population density of 621 persons per square mile.[32] Because special access customers are less likely to be clustered in smaller cities, and because smaller cities are less likely to attract CLEC facilities-based deployment (regardless of any construction cost differentials),[33] the addressability of special access customers in smaller cities would necessarily be less than the addressability of special access customers in larger cities.[34] Stated differently, if I had only concentrated my analysis on the very largest cities, it is likely that my estimates of addressability would have been *upwardly* biased and WorldCom would have been quick to point that out. Indeed, the positive relationship between city size and addressability is revealed in my results:

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competitive nature of special access services *throughout* the U.S. simply cannot be drawn by looking only at these six cities." (emphasis in original) (citation omitted)).

31. *WorldCom Comments*, *supra* note 2, at 30 (emphasis added).

32. U.S. Census Bureau, Land Area, Population, and Density for Metropolitan Areas: 1990, at Table 2 (Mar. 14, 1996) (downloaded from Census web site at http://www.census.gov/population/censusdata/90den_ma.txt).

33. WorldCom's own economists admit that CLECs are more likely to deploy facilities in densely populated areas. *See Declaration of A. Daniel Kelley and Richard A. Chandler*, on behalf of WorldCom Inc., at ¶ 29 (June 11, 2001) ("This, of course, explains why CLECs have chosen to concentrate their investment where telecommunications demand is most dense—the central business districts and some outlying business centers within large cities.").

34. CLECs have historically deployed fiber networks in the most densely populated MSAs. According to New Paradigm Resource Group, larger (and more densely populated) MSAs have more CLEC networks. For example, MSAs 21 through 30 have between four and eleven CLEC networks, whereas MSAs 61 through 70 have between one and six CLEC networks. *See* NEW PARADIGM RESOURCE GROUP, INC., CLEC REPORT 2001 (13 ed. 2001).

larger cities, such as Cleveland and Seattle, have a greater degree of addressability than do mid-sized cities, such as Tucson and St. Paul.

II. The Opponents Mischaracterize the Metrics Used to Characterize Actual and Potential Competition in the Special Access Services Market

17. Despite rejecting direct evidence of competitive fiber, AT&T argues such evidence is the only thing the Commission consider in its impairment decision. Any measurement device that could be construed as a "model," even if it assisted the Commission in assessing the data, must be discarded! But the model is a direct response to AT&T and other competitors, which have argued that existing networks cannot be economically expanded to serve additional customers. For this reason, I sought to provide a metric that would characterize the degree to which CLECs networks (1) currently reach or (2) could profitably be extended to reach special access customers.

18. In summary, my "theoretical modeling" is simply a means to give content to the data on CLECs' supply of special access facilities and the demand for special access services. The analysis is fundamentally sound and serves only to confirm what is evident from the market data: CLECs can deploy their own local networks in dense urban areas to serve large business customers.

A. The Opponents Mischaracterize the Metric Used to Portray Actual Competition

19. The purpose of my probit model is twofold. *First*, I sought to identify likely special access customers in the six survey cities. *Second*, I sought to relate (by distance) those potential customers to existing competitive fiber networks. Without using a predictive model that incorporates knowledge of an individual firm's characteristics, the Commission would be left to

assume that *every* customer in *every* building is equally likely to demand special access service. Unfortunately, that assumption would grossly understate the degree to which CLECs are *currently* serving special access customers. At the risk of appearing too theoretical, I estimated a probit model to determine which customers would be more likely to subscribe to high-cap services.

1. AT&T Confuses the Relationship Between the Cutoff Probability and the Degree of Addressability

20. The probit model allows me to score each business in the six sample cities according to its individual likelihood of using high-cap services. The cutoff probability is a subjective measure that determines which customers are ruled in or out of the pool of potential special access customers. A low probability cutoff ensures that more businesses are included in the pool of potential special access customers. AT&T is confused about a very simple relationship between the probability cutoff and the degree of addressability—namely, the *more* businesses that are included in the set of potential special access customers, the *more* difficult it is to demonstrate that the majority of all potential customers is served by existing CLEC fiber lines. Because the very characteristics that make a customer more likely to use high-cap services are correlated with that customer's decision to locate in densely populated areas, a smaller pool of potential special access customers will necessarily be easier to serve. At the same time, the location decisions of the largest customers are likely to influence the location decisions of the CLECs themselves.[35] Hence, a probability cutoff that is too low will understate the degree of

35. Indeed, the data actually confirmed this relationship—that is, at higher cutoffs levels, fewer potential customers were identified, but the addressability of those customers was higher.

addressability. But according to AT&T's misdirected logic, I artificially set the cutoff probability too *low*:

> On the other hand, if Dr. Crandall in fact used a cutoff probability of 0.1886 to draw telecommunications customers into the set of high-capacity customers, this is an arbitrarily low probability that would treat numerous customers with a low probability of purchasing high-capacity service as potential high-capacity customers.[36]

If I had artificially contrived a cutoff level, as the opponents suggest, I certainly would have set the cutoff level too *high*, so as to rule *out* firms from the set of potential special access customers.[37] Rather, as I explained in my declaration, I set the cutoff level at 18 percent to ensure that I would populate the cities with a sufficiently *large* number of potential special access customers. In particular, I chose a cutoff level that was associated with the estimated percentage of businesses that use a high-cap connection (5.8 percent).

2. AT&T Incorrectly Suggests That a Probit Model Might Not Be Applicable

21. In a second attempt to criticize the probit model, AT&T argues that I assumed, without ever proving, that the error terms of the probit model were normally distributed: "A sound statistical analysis, however, would examine the distribution of [the error term] (e.g. a graph of [the error term] based on the sample data) to justify the distribution assumption."[38] Thus, AT&T implies that another statistical model might have been more applicable in the present case.

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36. *AT&T "Economic" Study*, *supra* note 1, at 46-47. Z-Tel follows similarly contorted logic, insisting that I should have used a *higher* cutoff probability of 0.5 (50 percent). *See*, *Z-Tel Comments*, *supra* note 30, at 22, n.31 ("[Crandall] was required to adjust the probabilities of purchasing high-cap circuits to the much lower level of 0.1886 (18.86%) in order to have the probit model provide any result that was not absurd.").

37. Other commenters suggested that I set the cutoff probability too high. *See*, *e.g.*, *WorldCom Comments*, *supra* note 2, at 28 (arguing that not enough buildings in Seattle were included in the set of potential customers). Perhaps the Commission will recognize that, like Goldilocks, I set the cutoff probability just right.

38. *AT&T "Economic" Study*, *supra* note 1, at 47.

22. There are only two widely accepted estimation techniques that an economist can use to estimate a model with two discrete choices: a probit model or a logit model. A logit model assumes that the error term—that is, the residual that cannot be explained from the right-hand-side variables in the regression—is distributed exponentially. The probit model assumes that the error term is distributed normally. Both are "mound-shaped" probability functions. The only difference is that the distribution function for the probit model has slightly thinner tails—that is, the probit model finds fewer observations in the extremes of the distribution. Indeed, the coefficients generated by both models are quite similar, and the predicted probabilities from the respective coefficient estimates are nearly identical.[39] AT&T's criticism of my modeling choice is without merit.

3. Sprint Incorrectly Suggests That the Probit Model Rules Out Relevant Customers

23. Sprint argues that the probit model "self-selects a portion of the exchange access market in order to produce the desired result."[40] Like AT&T and WorldCom, Sprint complains that I limited my analysis to the addressability of potential high-cap customers only—the opponents would prefer that I examine the addressability of *all* local telecommunications customers. Because the probit model focuses on a non-existent market, Sprint argues, the probit model and its findings on addressability should be discredited:

> By limiting the analysis to high-capacity businesses, the Crandall affidavit shows, not surprisingly, that much of this subset of the special access market tends to be clustered, and that CLECs have targeted those clustered areas with fiber build-outs. As Sprint stated in its initial comments, there is no logical or factual basis

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39. For a comparison of the logit and probit models, see WILLIAM H. GREENE, ECONOMETRIC ANALYSIS 875-78 (Prentice Hall 3rd. ed. 1997).

40. *Sprint Comments*, *supra* note 3, at 13.

> for differentiating the exchange access market in terms of the types of end user customers served in that market.[41]

What is most noteworthy about that comment is that Sprint *agrees* with my findings that (1) special access customers tend to be clustered and (2) CLECs have targeted those areas with fiber build outs. In other words, Sprint *agrees* with my assessment of competition. Its dispute is limited to matters of market definition, and even on that front, for the reasons discussed in my original declaration, Sprint is wrong.[42] With respect to product market definition, Sprint should consult the *Horizontal Merger Guidelines* to understand the role of demand characteristics in defining markets.[43] With respect to its perceived self-selection fallacies of my analysis, Sprint should consult an econometrics textbook to understand how the probit model accurately links a customer's characteristics to its propensity to subscribe to high-cap services.[44] At least Sprint and I can agree that, conditional on the existence of a special access market, potential customers in that market are currently served by facilities-based CLECs.

B. The Opponents Mischaracterize the Metric Used to Portray Potential Competition

24. The purpose of my breakeven analysis is to characterize the state of *potential* competition. Based on the patterns of actual CLEC deployment in the past, and an appreciation of the expected costs and benefits of expansion, it is possible to make informed predictions about which buildings CLECs are likely to serve in the future. While such models should not serve as the *sole* basis upon which the Commission makes its impairment decision, the analysis can be

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41. *Id.*
42. *Crandall Reply Declaration*, *supra* note 5, at ¶¶ 16-20.
43. Department of Justice and Federal Trade Commission, Horizontal Merger Guidelines at § 1.0 (Apr. 2, 1992) [hereinafter *Merger Guidelines*] (explaining that "[m]arket definition focuses solely on demand substitution factors—i.e., possible consumer responses.")
44. *See, e.g.*, GREENE, *supra* note 39, at 871-78.

used to supplement market evidence on the issue of a CLEC's ability and incentive to expand its network.

25. AT&T grossly mischaracterizes my model to try to poke holes in my breakeven analysis. For example, AT&T suggests that the breakeven model assumes "that the competitive LEC does not have to expend capital before it is able to generate revenues from its new facilities."[45] Buried in a footnote near the end of its reply, AT&T admits that its earlier assertion concerning revenue timing is incorrect.[46] To set the record straight, the Cambridge Strategic Management Group (CSMG) cost model conservatively assumes that costs are incurred with the build-out *before* customers are acquired—that is, before revenues begin to flow. In fact, CLECs often will not construct a lateral extension from their existing network to an off-net building until they have signed up customers in the building.

26. In another mischaracterization, concerning the timing of revenues and expenses, AT&T asserts that the CSMG model fallaciously measures CLECs' revenues in perpetuity, without accounting for the CLECs' future marketing expenses.[47] In fact, CSMG assumes a customer care cost, which includes ongoing costs expended to retain customers, equal to 4 percent of revenues. This cost would include customer care, retention, and ongoing marketing to sell additional services.[48]

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45. *AT&T "Economic" Study*, *supra* note 1 at 24.

46. *Id.* at 39 n.33 (explaining that the breakeven model "has a negative cash flow in Year 1 of –102,151."

47. *Id.* at 27-28.

48. Perhaps the most egregious mischaracterization committed by AT&T occurs on page 33 of the unsigned economic study, where AT&T mistakenly interprets the charts on page 11 of the CSMG backup filing as real data, and accuses CSMG of producing contradictory results. This page in the CSMG backup filing was only intended to demonstrate the process of how the CSMG cost study would presumably be used in my declaration. The graphs are illustrative only and do not depict real results. In fact, CSMG did not perform any revenue-related analysis and only modeled the cost side and the resulting revenue needed to attain a net present value equal to zero.

27. Finally, the Commission should be reassured that my analysis replicates the calculus used by "real-world" CLECs, such as WorldCom. In fact, CSMG has designed the business plans of over 50 "real-world" CLECs. Moreover, according to Edwin A. Fleming, Senior Manager of Strategic Business Planning for WorldCom, WorldCom uses the *same* calculus when deciding whether to extend its network:

> For larger buildings where WorldCom projects WorldCom customer demand of several DS-3s or optimal level circuits, the building add decision is made using a screening process that compares projected revenues to the cost of the building add and that also takes into account the risk that revenues will be lower than projected.[49]

WorldCom's explanation is consistent with my breakeven analysis, and provides further support for use of the model.

1. The Opponents Incorrectly Claim That the Breakeven Model Understates the Cost of Extending the Network

a. Contrary to the Assertions of AT&T, Common Costs Should Not Enter the CLEC's Decision to Expand Its Existing Network

28. AT&T faults my "incremental" approach to model a CLEC's decision to expand its existing fiber network. In particular, AT&T claims that the breakeven cost model does not take into consideration any of the "significant costs of the fiber backbone and associated electronics," or the "necessary back office systems and unused network capacity to handle all the incremental special access traffic."[50] That critique is flawed for at least two reasons. *First*, the CSMG model includes costs associated with the network electronics that are directly attributable to the additional building—for example, the ATM and ADM Port Cards in the CLEC central office. In particular, CSMG assumed that there was sufficient unused capacity in the CLEC

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49. *Fleming Declaration*, *supra* note 29, at ¶ 10.

network to handle the traffic associated with *one* additional building. Given the glut of fiber capacity, this assumption seems very reasonable.[51]

29. *Second*, sophisticated economic agents (including large, multi-national firms) succeed by exploiting *future* margins; they do not look backwards when deciding whether to begin a new project.[52] Instead, the CLECs would only consider the incremental costs that are contained in the CSMG cost study. They would not allow common costs to contaminate their expansion decision.

30. From this (faulty) assumption, AT&T makes the farfetched conclusion that, according to the breakeven model, "additional local and special access revenues garnered at newly-connected buildings have a 100 percent profit margin."[53] That assessment could not be farther from the truth. For example, for a 500 foot extension in Cleveland with net present value (NPV) equal to zero, the CSMG cost model provides gross profit margins over the course of the ten year forecast of 51 percent to 59 percent, EBITDA profit margins of 36 percent to 52 percent, EBIT profit margins of -6 percent to 24 percent, and net profit margins of –6 percent to 17 percent.[54]

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50. *AT&T "Economic" Study*, *supra* note 1, at 15.

51. *See, e.g.*, Michael Selz, *Arguss is Digging Its Way Out of Telecom Downturn*, WALL ST. J., June 19, 2001, at B2 ("The rush to improve the nation's communications network glutted the market with fiber-optic capacity, 97 percent of which is unused.").

52. For an example of marginal analysis in real business decision problems, see WILLIAM J. BAUMOL & ALAN S. BLINDER, MICROECONOMICS: PRINCIPLES AND POLICY 198-99 (Dryden 7th ed. 1997). Z-Tel also accusing me of failing to consider common costs. *See, Z-Tel Comments*, *supra* note 30, at 19 (July 11, 2001) ("A critical flaw in the BOC and Crandall analysis is the assumption that simply because one or a few CLECs are present in a particular portion of a market means that other CLECs are not impaired in their ability to provide service. . . . While Crandall acknowledges that sunk costs are required to enter the 'special access services market,' he fails to recognize that those sunk costs by definition limit the number of entrants in a market." (citation omitted)).

53. *AT&T "Economic"* Study, *supra* note 1, at 15.

54. CSMG, CLEC NETWORK EXTENSION COST MODEL, Financials Worksheet (Apr. 26, 2001).

b. Contrary to the Assertions of AT&T and WorldCom, CSMG Did Not Underestimate the Trenching Costs

31. AT&T notes that the Commission independently determined trenching costs to be between $27.79 and $42.59 per foot for generically defined dense urban areas.[55] CSMG, however, was asked to determine the costs for the *specific* markets studied after discussing the issue with contractors and city officials. Some particularly dense cities with unusual terrain, obstacles, and high labor costs certainly will entail higher costs, in line with the Commission's estimates. It should be noted, however, that cities with higher trenching costs are likely to have higher revenue opportunities.

32. In any event, AT&T's argument proves little because the breakeven model is relatively insensitive to trenching costs. For example, if the CSMG trenching costs are increased by nearly 100 percent (from $34.16 to $60.59 per foot), the net effect on the revenue breakeven frontier at 500 feet is an upward shift of only 4.6 percent to 7.8 percent for the various markets. According to a sensitivity analysis, I find that such a change in the breakeven frontier does not significantly alter my conclusions.[56]

c. Contrary to the Assertions of AT&T and WorldCom, the Straight-Line Assumption on Connecting Buildings to Nearest Fiber Lines Does Not Significantly Affect the Breakeven Revenues

33. AT&T and WorldCom assert that the assumption about straight-line connections between off-net buildings and existing CLEC fiber networks dramatically impacts the breakeven

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55. *AT&T "Economic"* Study, *supra* note 1, at 21. WorldCom also accuses CSMG of underestimating trenching costs. *See Fleming Declaration*, *supra* note 29, at ¶ 18 (arguing that "trenching costs in the central business districts of major cities are often much higher, at least $70 to $100 per foot."). *See also* Comments of Yipes Transmission, Inc., at 13 (July 11, 2001) ("[T]he BOCs grossly underestimate the cost of [trenching] fiber facilities.").

calculations: "In reality, public rights of way run parallel to streets and rarely run in a straight line from a particular building to a competitive LEC's backbone fiber."[57] This assertion is overstated for two reasons. *First*, while it is true that lateral extensions are not always built as-the-crow-flies, straight-line distance can be used as a simplifying assumption. Given the grid layout of the streets in the urban environment where these customers are found, and given that the CLEC can choose where the extension will join the existing network, it is likely that the vast majority of extensions will run straight down a side street to the new customer's location.[58]

34. *Second*, even in those limited instances where the straight-line distance does not equal the length of the extension, this difference does not significantly affect the breakeven calculation. Consider what might be a worst-case scenario in which the "legs" of an actual route follow the sides of an equilateral triangle, while the airline distance follows the hypotenuse. In this case, the length of extension would be 1.41 times the airline distance. If this applied to half of the extensions—which is unlikely for the reasons listed above—the average distance would be

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56. For example, assuming the CLEC captures 50 percent of the building's revenues, a 4.6 percent upward shift in the breakeven frontier reduces the percentage of special access revenues above the breakeven frontier in Cleveland from 77.3 percent to 76.9 percent.

57. *AT&T "Economic"* Study, *supra* note 1, at 16. *See also WorldCom Comments*, *supra* note 2, at 27 (alleging that CSMG assumed "that the lateral would take the shortest path from the CLEC's network to the building and by underestimating the per-foot trenching costs.").

58. The difference between airline miles and route miles has already been debated extensively in the context of the Commission's cost model for universal service. However, the facts are very different in this analysis. In the universal service model, a new network is constructed from scratch, linking each customer location with a point, namely the location of the wire center. The route mileage is also affected by winding country roads, convoluted streets in residential neighborhoods, and natural obstacles in rural areas. In this case, we consider only extensions from existing fiber routes. We are thus calculating the distance to a line, not a single point, and we are free to choose where the new lateral will join the existing backbone. Suppose, for example, that an existing fiber runs along K Street in Washington. An extension to reach a building on any cross street, such as 20th Street, would run in a straight line. This is particularly true since the model considers a separate extension for each customer location. The distance would only include a lateral component if it were necessary to route around some obstacle.